



Trans-Lake Washington Project

Lake Washington Navigational Study

Prepared for

**Washington State Department of Transportation
Office of Urban Mobility**

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ACRONYMS

NOAA	National Oceanic and Atmospheric Administration
SEATRAN	Seattle Department of Transportation
WSDOT	Washington State Department of Transportation



1. INTRODUCTION

The purpose of this study is to evaluate past and current navigational requirements on Lake Washington and develop recommendations for future navigational requirements in the vicinity of the Governor Albert D. Rosellini Evergreen Point Floating Bridge (SR 520)(Structure Identification Number 520/8 0006486A). These recommendations are intended to preserve the public right of navigation and prevent interference with interstate and foreign commerce per Section 9 of the Rivers and Harbors Act of 1899 and the General Bridge Act of 1946.

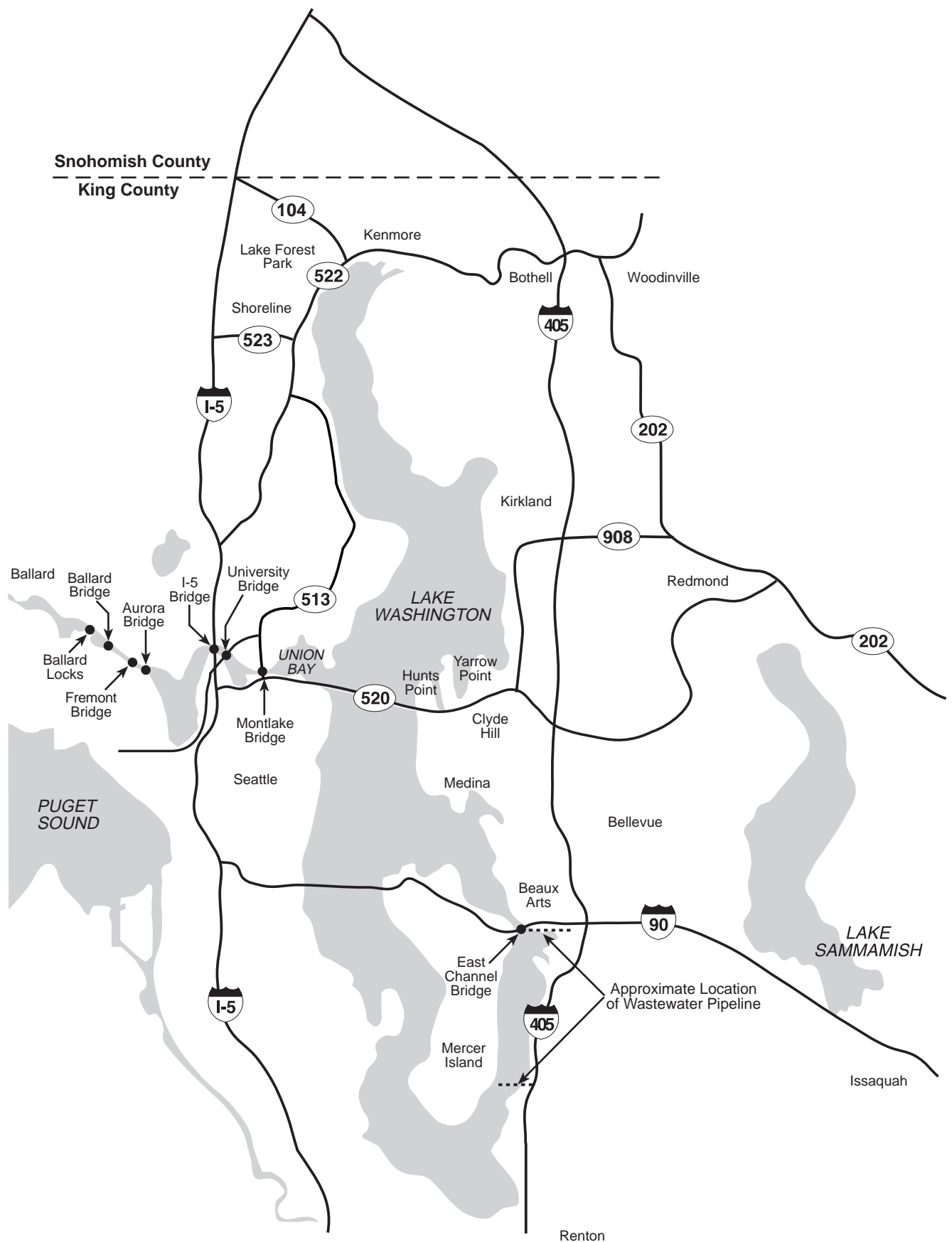
The navigation study area was defined as the Ship Canal from the Ballard Locks through the Union Bay Corridor to the south end of Lake Washington (Figure 1). This study focuses on two types of information: 1) existing navigational clearances of all structures crossing the Ship Canal and Lake Washington; and 2) existing use between the University Bridge and the south end of Lake Washington.

Data was collected on types of vessels, typical routes, and purpose of travel for several categories of use including recreational, commercial, construction, industrial, and military. Navigation between the south end of Lake Washington and Puget Sound has nine potential restriction points:

1. Interstate 90 (I-90) East Channel Bridge
2. SR 520
3. Montlake Bridge
4. University Bridge
5. Interstate 5 (I-5) Bridge
6. Aurora Bridge
7. Fremont Bridge
8. Ballard Bridge
9. Ballard Locks.

A recommendation for replacement of the SR 520 Bridge must consider (1) replacement of the bridge with existing navigational envelopes, (2) removal of the center draw-span on the floating bridge, (3) removal of either/both high-rise structure on the east and west sides of Lake Washington, and (4) a connection from SR 520 corridor to the northside of the Montlake Cut for High Capacity Transit (HCT) or freeway ramps. In order to improve the operational reliability of the SR 520 corridor, a recommendation to remove the existing draw-span is being considered and must be supplemented with an adequate replacement of navigational corridor through SR 520. The recommendation for a high rise on the east side is summarized in Section 4.1. The recommendation for the Ship Canal/Union Bay corridor, either a high rise, bridge, or cut and cover tunnel, is summarized in Section 4.2.





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Figure 1
Navigation Study Area

2. DATA COLLECTION

Data was collected using the methods summarized below. A complete list of contacts is provided in Table 1.

- Phone conversations with:
 - Local tugboat companies and their clients.
 - Construction and crane companies.
 - Private marinas located south of SR 520.
 - City of Renton Departments of Transportation and Economic Development and the City of Bellevue Department of Planning and Community Development.
 - Seattle Department of Transportation (SEATRAN) for Montlake and University bridge data.
 - Washington State Department of Transportation (WSDOT) for SR 520 bridge logs.
- Review of Nautical Chart No. 18447 published by the US Department of Commerce, National Oceanic and Atmospheric Administration (NOAA).

Table 1. Navigational Study Contact List

Company/Organization	Contact Name	Phone Number
Recreational		
Coulon Park	none	Field Investigation
Leschi Marina	Vance Alles	206-325-3730
Mt. Baker Sailing and Rowing Club	none	Field Investigation
Newport Yacht Club	Linda Hogan	425-747-3291
Meydenbauer Yacht Club	none	425-454-8880
Parkshore Marina	David JorDan	206-725-3330
Rainier Yacht Club	Bob Brown	206-722-9576
Seattle Yacht Club	John Bramstedt	206-325-1000
Commercial/Industrial		
Argosy Cruise Line	Don Wickland	206-623-1445
Barbee Mill	Art Hall	425-226-3900
Foss	Steve Spencer	206-281-3800
Island Tug and Barge Co.	David Zanzig	206-938-0403
Lynden Tug	none	206-241-8778
Madden Construction	Dale Madden	425-455-2500
Manson Construction	Pat McGerry	206-762-0850
SeaCoast Towing	Francis Lee	206-443-9418
Spirit of Puget Sound	none	206-674-3500



Table 1. Navigational Study Contact List (Continued)

Company/Organization	Contact Name	Phone Number
University of Washington	Dan Schwartz	206-543-5062
Waterfront Construction	Dean Simmons	206-548-9800
Western Towboat Inc.	Jeff Schlesinger	206-789-9000
Government		
Ballard Locks	Lockmaster	206-783-7000
City of Renton Department of Economic Development	Shawna Mullhall	425-430-6589
City of Bellevue Department of Planning and Community Development	Kathleen Burgess	425-452-6866
SEATRAN	JoAnne McGovern	206-386-4208
US Navy	Rick Huling	1-800-334-9149
WSDOT	Archie Allen	425-822-4163



3. RESULTS

Chapter 3 presents the results of the investigation and data collected. In summary, the following facts were determined:

- Vessels accessing the Ballard Locks are limited to less than 80 ft wide, 760 ft long, and a draft of less than 29 ft.
- Vessel traffic requires the Montlake and University Bridges to be opened an average of 8 and 10 times per day, respectively.
- Recreational vessels, although difficult to quantify, are able to pass under the existing SR 520 east highrise, except for one vessel that makes two annual trips through the draw-span.
- Smaller recreational vessels, also difficult to quantify, are able to pass under the existing SR 520 west highrise and the lower fixed bridge approach spans.
- Commercial and industrial vessels require approximately four annual bridge openings of the SR 520 draw-span.

3.1 EXISTING NAVIGATIONAL CORRIDORS

The navigational clearances for all bridges located between Puget Sound and Lake Washington are summarized in Table 2. This information can be used to identify route restrictions. Depths through the Ship Canal to Lake Washington are equal to or greater than 30 ft, except at the Ballard Locks, which has a depth of 29 ft over sills (Figures 2 and 3).

Table 2. Existing Bridge Navigational Clearance

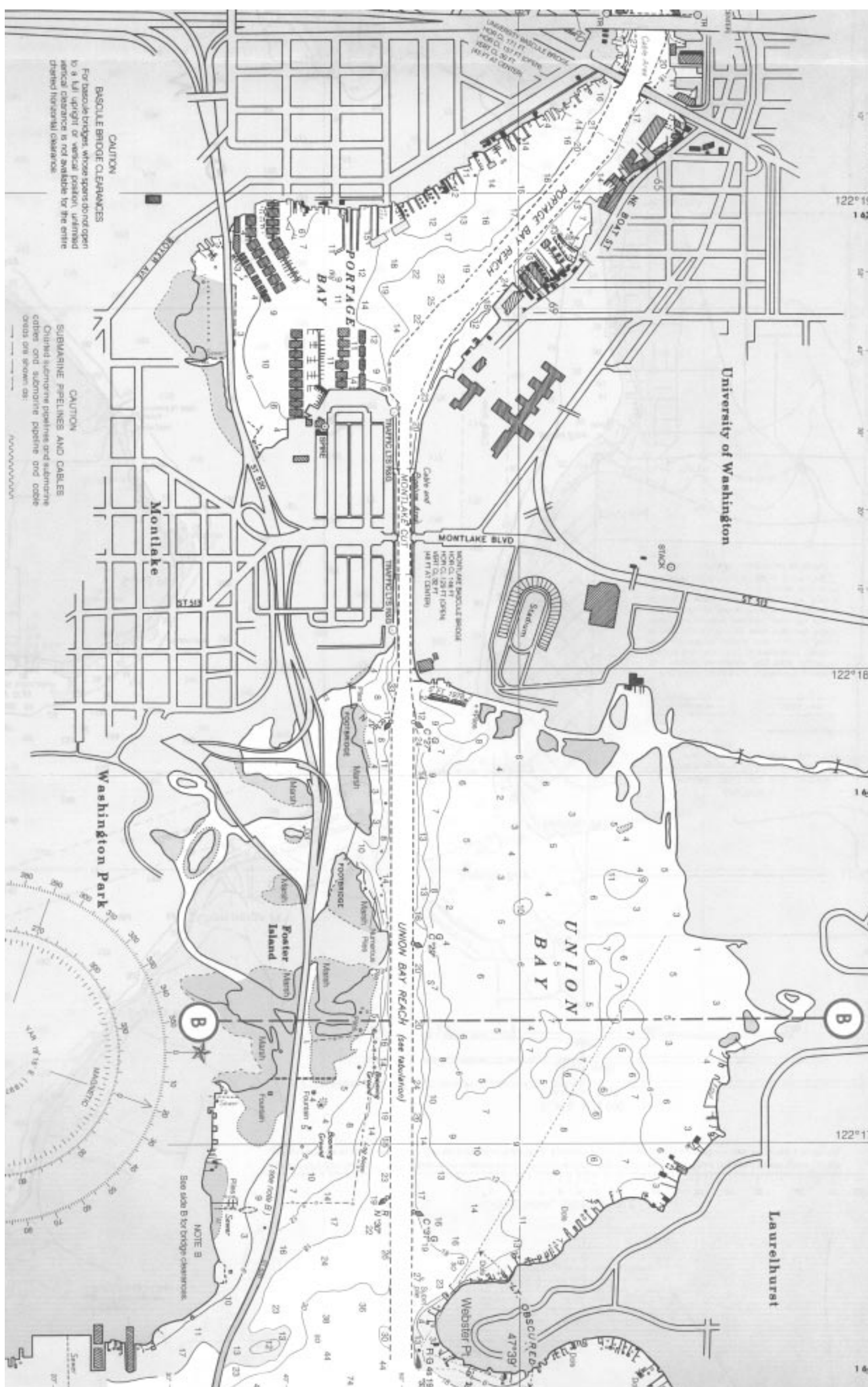
Bridge	Height Above Water ^a	Width Restrictions ^b
Ballard Locks	N/A	80 ft
Ballard Bridge (draw-span)	46 ft	150 ft
Fremont Bridge (draw-span)	14 ft	150 ft (120 ft open)
Aurora Bridge (SR 99)	136 ft	150 ft
I-5 Bridge	127 ft	146 ft
University (draw-span)	45 ft	146 ft
Montlake (draw-span)	48 ft	146 ft (129 ft open)
SR 520		
East highrise	55-64 ft	207 ft
West highrise	44 ft	206 ft
Draw-span	N/A	200 ft
I-90 ^c		
I-90 East Channel Bridge	71 ft	200 ft
I-90 west fixed span pontoon bridge	29 ft	195 ft
I-90 east fixed span pontoon bridge	29 ft	195 ft

a) Vertical clearances are referenced to mean water level (21 ft above MLLW). Lake Washington water surface elevation is regulated by the locks and is 2 ft lower during winter months to reduce waterfront/beach erosion; elevations correspond to high regulated lake level.

b) The limiting navigational width in the ship canal is 146 ft; however, it is only 100 ft in width at the full depth in the Montlake Cut.

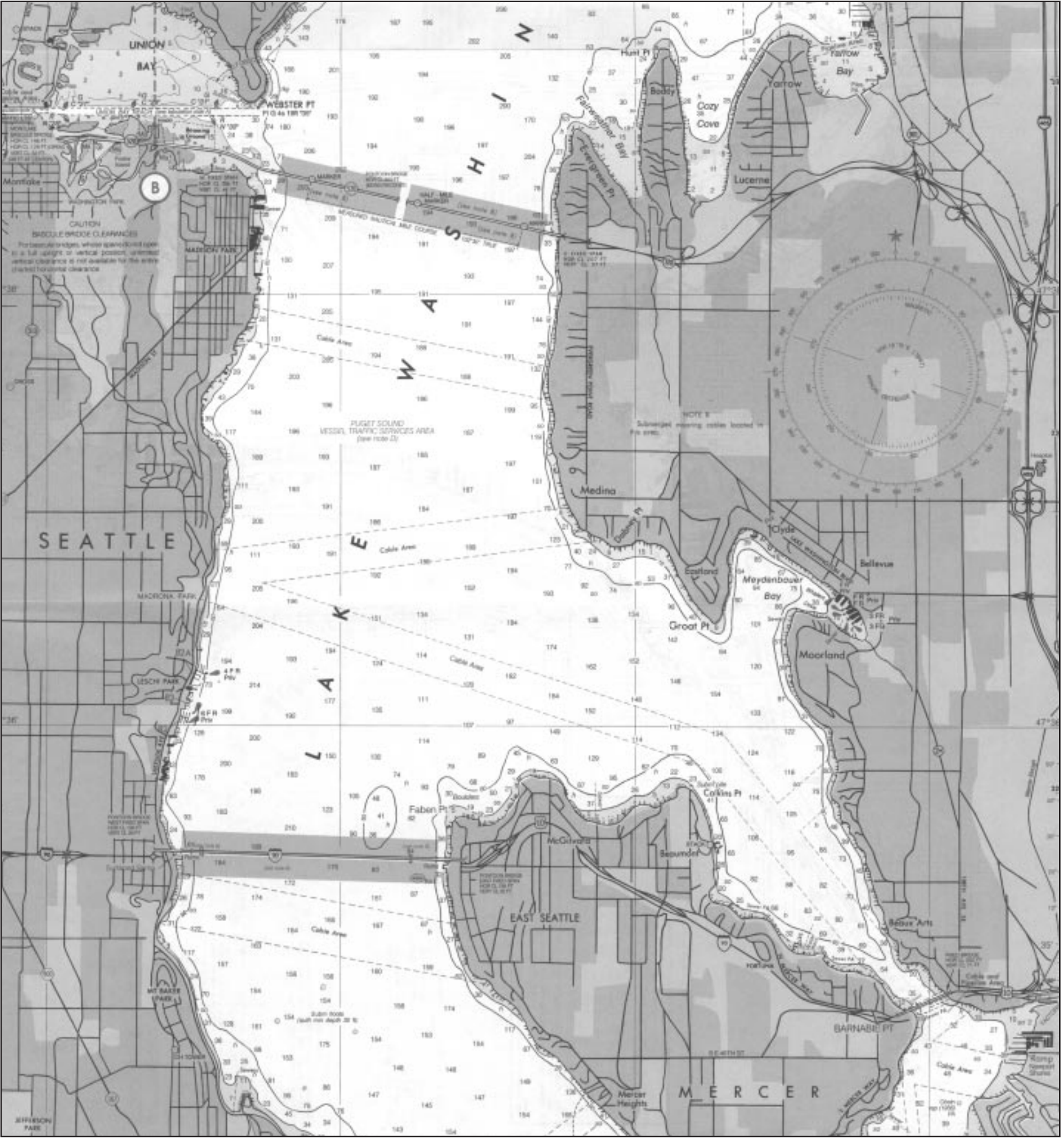
c) I-90 does not have a draw-span.





Source: Nautical Chart 18447, Lake Washington Ship Canal and Lake Washington, U.S. Department of Commerce National Oceanic and Atmospheric Administration.

Figure 2
Navigational Corridor
University Bridge to Union Bay



Source: Nautical Chart 18447, Lake Washington Ship Canal and Lake Washington, U.S. Department of Commerce National Oceanic and Atmospheric Administration.

Figure 3
Navigational Corridor
SR 520 and I-90

Bridge logs recording the total annual openings were evaluated to determine the frequency of vessel traffic. WSDOT has documented all SR 520 bridge openings (Table 3). In general, the number of openings required for vessel passage has decreased over the last five years. The bridge was opened 35 times in 2000 and 39 times in 1999 for maintenance, any bridge that removed the drawspan would not require this type of routine maintenance work.

Table 3. SR 520 Bridge Log Summary of Annual Openings^a

	2000 ^b	1999	1998	1997	1996	1995
Other	3	2	0	0	2	0
Ships	6	6	11	13	3	14
Total	9	8	11	13	5	14

a) Other openings are primarily due to weather conditions.

b) Data collected through October 2000, not used to calculate averages.

SEATRAN documents openings of the Montlake and University bridges. Both of these bridges are opened more frequently than the SR 520 Bridge (Table 4). However, this increase could be related to the fact that both bridges have less navigational clearance, and that vessel traffic primarily goes north in Lake Washington after passing through the Montlake Cut.

Table 4. Summary of Bridge Openings^a

Year	Total Number of Bridge Openings		
	SR 520	Montlake	University
2000 ^a	44	2,464	2,841
1999	47	2,791	3,468
1998	60	3,233	4,049
1997	36	3,088	3,938
1996	32	3,471	4,213
1995	27	3,524	4,166
Average	47	3,146	3,917

a) Data collected through October 2000, not used to calculate averages

3.2 EXISTING VESSEL TRAFFIC

3.2.1 Recreational Use

Although recreational traffic on Lake Washington within the project corridor is the largest component of navigation uses, details on this traffic were difficult to assess. Marinas do not record the height or width of the vessels they moor. Also, a large number of private docks and vessels are located in the corridor. This study focused on recreational vessels that require the SR 520 Bridge to be opened. Only one recreational vessel, a sailboat named the Ninna OoTaki, was identified in the SR 520 Bridge logs as requiring the bridge to be opened. This boat can pass



under the I-90 East Channel Bridge. The owner of this boat was contacted (Parkshore Marina) and he confirmed that his boat is the only recreational vessel that requires the bridge to be opened at mid-span. Table 5 summarizes the marinas that were contacted for this study.

Table 5. Recreational Vessel Use Within the Study Area.

Marina	Open slips	Max. Vessel Dimensions (ft)			Notes
		Height	Length	Draft	
Coulon Park	N/A				No permanent moorage, no large boats observed.
Leschi Marina		65		6	East highrise passes most boats, estimate 193 boats require opening Montlake Bridge.
Meydenbauer Bay Yacht Club	6				No information about vessel size or passage requirements.
Mt Baker Sailing and Rowing Club	N/A				Observed small (one person) sail boats.
Newport Yacht Club	50	40			Approximately 12 boats need Montlake opened.
Parkshore Marina	75	70	64	7	Ninna OoTaki 2 openings yearly for SR 520 Bridge; other boats can make it under the SR 520 Bridge (some have bent antennas).
Rainier Yacht Club					All boats can pass under the I-90 East Channel Bridge. No additional information provided.
Seattle Yacht Club ^a	100				Most use Ship Canal to get to Puget Sound; do not usually go to Lake Washington.

a No information on vessel size available

Based on conversations, it is likely that there are no other recreational vessels permanently moored on Lake Washington that require opening the SR 520 floating bridge. Interviews with local marina operators indicate that occasionally “rogue” vessels, including the America Cup trainer, enter the lake, and may require the SR 520 Bridge to be opened at mid-span.

3.2.2 Commercial/Industrial Use

Commercial and industrial uses of Lake Washington that require opening the SR 520 Bridge have decreased over the last 5 years (Archie Allen WSDOT, Personal Communication). In 2000 and 1999, less than five openings per year were documented for commercial/industrial vessels. It is anticipated that future development will not require additional navigational clearances. The primary commercial uses identified on the lake are cruises/tours and construction. No large commercial or industrial use of the lake south of SR 520 were identified. Table 6 summarizes the commercial and industrial users contacted during this study. Interested parties can contact



the Washington State Department of Licensing to obtain information about the owner and destinations of these vessels.

Argosy is the primary cruise line on Lake Washington. They provide up to six regularly scheduled daily trips on Lake Washington during the peak season with additional trips added for private parties. None of the Argosy vessels regularly scheduled for tours on Lake Washington require opening the SR 520 Bridge.

Table 6. Commercial/Industrial Vessel Usage Summary

Marina	Trips on LW	Height (ft)	Beam (ft)	Length (ft)	Draft (ft)	Notes
Argosy Cruises:						
Champagne Lady	2 trips/peak day 3 trip/ non-peak day		18	77		Peak is from April to October Additional trips for private parties Trip estimates are for round trips
MV Kirkland	3 trips/ peak day 1 trip/ non-peak day	35	40	110		
Spirit of Seattle		38	32	115		One recorded trip through SR 520 Bridge may have followed another vessel; not opened for Spirit of Seattle
Royal Argosy	Tallest mast on Lake Washington	45	42	180	8	Uses I-90 East Channel Bridge
Barbee Mill	None					They have not used log rafts or barges for 50 yrs; they ship only via trucks.
Foss/General Construction	3-4 round trips/yr (south of SR 520)	144 to boom	60	117	6	Floating crane, can modify boom to have 8 ft of clearance on I-90 East Channel Bridge.
Island Tug and Barge Co.	7 round trips/week (none south of SR 520)	40		85-90 ft (350 w/ barge)	16	Route from Kenmore to Shilshole, Glacier Sand, and Gravel (10-yr contract)
Lynden Tug						Only in Puget Sound
Madden Construction	Multiple	38	65		15	Currently moored in Renton; needs passage for work on Puget Sound. Able to pass under the I-90 East Channel Bridge after modifying barge.
	1-2 times/yr for work on Mercer Island (4 trips) Smaller vessels go to Kenneydale Mill	110 to boom	78	200		Can be modified to clear the East Channel Bridge. They are concerned about navigational passage for emergency bridge construction (I-90 bridge construction was limited because equipment could not quickly access the area).



Table 6. Commercial/Industrial Vessel Usage Summary (Continued)

Marina	Trips on LW	Height (ft)	Beam (ft)	Length (ft)	Draft (ft)	Notes
Seacoast Towing	None south of SR 520					Kenmore - Glacier Sand and Gravel
Spirit of Puget Sound	Almost never	50	35	175	6	
University of Washington	8-9 trips/yr	31	19	65	6.8	"The Barnes"
	Seldom or never	110	52.5	274	19	"Thomas G. Thompson"
Waterfront Construction	20 trips/month	N/A	50	100		Currently moored in Lake Union, they have 6 barges. Height can be adjusted by lowering boom to pass SR 520 east highrise.
Western Towboat, Inc.						Only push things under SR 520 Bridge for hydro races and dock construction

Foss runs a crane derrick on Lake Washington and makes approximately 3 to 4 trips south of SR 520 per year. The derrick is 144 ft to the boom, 117 ft long, 60 ft wide and drafts 6 ft; this vessel can be modified to clear the I-90 East Channel Bridge.

Another use identified by barge operators and contractors is emergency construction. Two sewer lines are located under Lake Washington between Mercer Island and Bellevue. One line appears to follow the I-90 East Channel Bridge; the other is located at the southern end of Mercer Island and ties into the main sewer line just north of Renton. If these lines rupture, large cranes may be required for emergency repair work. King County Department of Natural Resources, Wastewater Treatment Division, operates these lines and can be contacted for more information at (206) 684-1469. Emergency construction may also be required for floating bridge repair work.

3.2.3 Military Use

There is one recorded instance of a Navy ship passing through the SR 520 Bridge draw-span in 1993. The Navy Department of Public Affairs was contacted and they stated that the Navy does not use Lake Washington and does not need access to the south end of the lake (Rick Huling, Personal Communication November 2000).

3.2.4 City of Renton Use

The City of Renton does not have any regular activities that require barge traffic. However, approximately every ten years they use barges to dredge the Cedar River. The City also anticipates that barges may be needed to clean up the Port Quendall site if redevelopment plans are approved (Shawna Mullhall, Personal Communication November 2000). The City does not anticipate the need for any vessel traffic that cannot be served by existing navigational corridors.



3.2.5 City of Bellevue Use

The City of Bellevue does not have any regular activities that require barge traffic (Kathleen Burgess, Personal Communication January 2001).

3.3 FUTURE DEVELOPMENT

The cities of Renton, Bellevue and Seattle and Boeing were contacted to determine any future development needs south of the SR 520 corridor that would rely on barge/large vessel traffic.

The City of Bellevue does not have any plans for development along the shoreline that would require barges and they stated that the shoreline is reserved for private marinas (Kathleen Burgess, Personal Communication January 2001).

The City of Renton stated that approximately every ten years they use barges to dredge the Cedar River. The City also anticipates that barges may be needed to clean up the Port Quendall site if redevelopment plans are approved (Shawna Mullhall, Personal Communication November 2000). The City also says that a project by Stoneway Concrete Inc (a division of Gary Merlino Construction Co.) is planned (Kayren Kittrick, Personal Communication January 2001). The project would develop a concrete production plant on land recently purchased from Boeing. Stoneway Concrete (Micheal Merlino 206-762-9125) was contacted but did not return phone calls related to the project, future shipping needs on Lake Washington are unknown. The City does not anticipate the need for any vessel traffic that cannot be served by existing navigational corridors.

The City of Seattle is currently updating their Comprehensive Plan, which will indicate land use along Lake Washington, and should be available for use in February 2001. For land use information contact Ann Sutphin at the City of Seattle Office of Strategic Planning 206-684-8374.

Boeing announced plans to abandon manufacturing of aircraft at the Renton Plant, and have recently sold a portion of their property to Merlino Construction Company for development. For more information about Boeing's development plans at the Renton Site contact Ron Cero 206-544-5905.



4. SUMMARY DISCUSSION

Based on the existing navigational constraints on Lake Washington and the Ship Canal, information about the current and past frequency and size of vessel traffic on Lake Washington, and anticipated future navigational needs, the following navigational clearances should be provided for any new structure on Lake Washington.

4.1 SR 520 AND I-90 CORRIDOR

Any modification to the existing SR 520 Bridge should at a minimum maintain the existing navigational envelope of 70 ft vertical clearance, 200 ft horizontal clearance, and 30 ft of depth (Figure 4). The two main design options are (1) retain the draw-span, or (2) construct a highrise structure. If the existing draw-span at mid-lake is removed, design of the highrise structure should be based on the following information:

- Although the SR 520 Bridge at mid-span currently does not have a limiting height, the I-90 East Channel Bridge has a maximum navigational clearance of 70 ft. Based on initial research, this height is adequate to allow passage of all vessels that need access to the south end of Lake Washington.
- Both SR 520 Bridge at mid-span and the I-90 East Channel Bridge provide 200 ft navigational width.
- Based on initial research, the largest barges on Lake Washington draft 16 ft. The Ballard Locks allow 29 ft of draft. Bathymetry of the lake at the SR 520 Bridge mid-span and the I-90 East Channel Bridge indicate that greater than 30 ft of draft is available (Figure 4).
- The topography of the ground and underwater provide a superior opportunity for smooth roadway profiles at the shoreline transition on the east side of the lake.

Although there are several options for modification to the SR 520 Bridge, it is recommended that the Build Alternatives for the Evergreen Point Bridge be designed with navigational clearance in only one location.

4.2 SHIP CANAL/UNION BAY CORRIDOR

In addition to modification on the existing SR 520 corridor, some alternatives may involve design options that cross the Ship Canal and Union Bay. Based on existing facilities in the area, design of these alternatives (either a highrise, drawspan, or tunnel) should maintain a navigational corridor with at least 146 ft of horizontal clearance and 30 ft of depth. The navigational envelope for this location should consider:

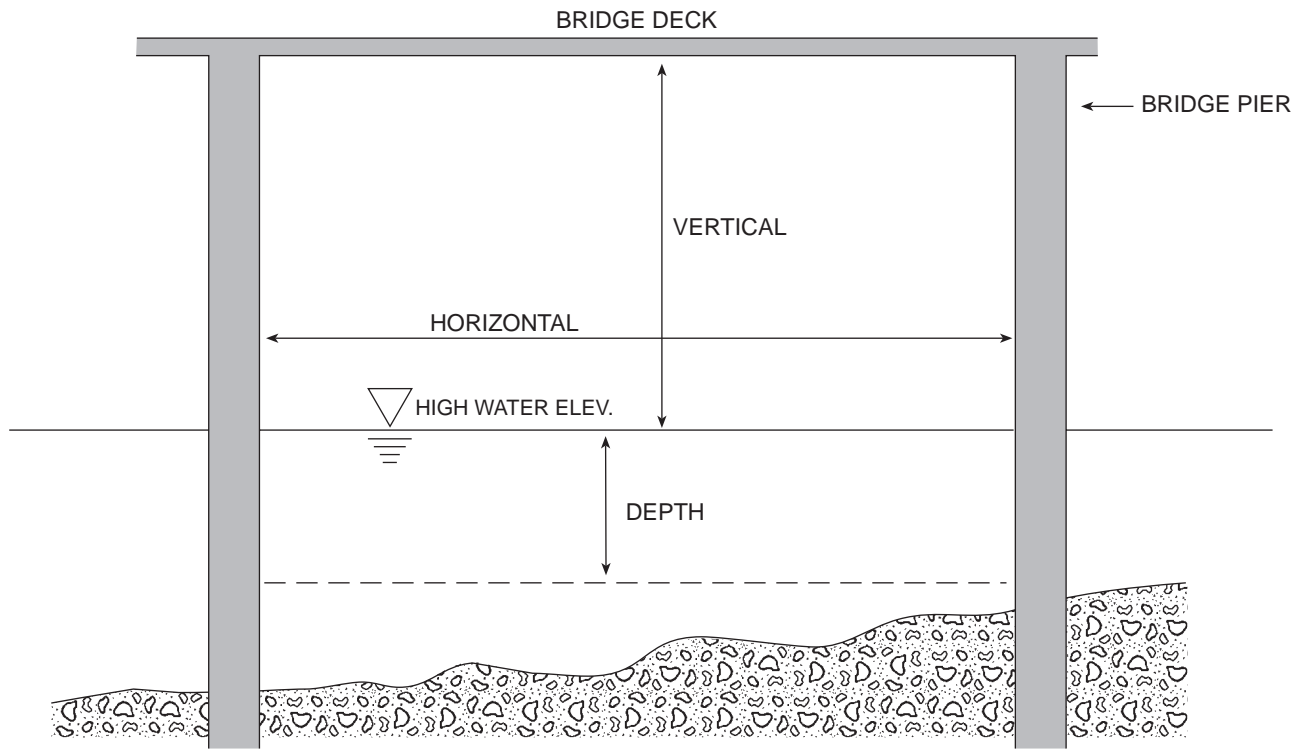
- The I-5 Ship Canal Bridge provides a vertical clearance of 127 feet.
- The ship canal is limited in width to 146 ft, which would determine the minimum horizontal clearance. The SR 520 Bridge at mid-span and the I-90 East Channel Bridge provide 200 ft navigational width. The existing navigational corridor through Union Bay is 200 ft in width.



- The existing Union Bay Navigational corridor provides a depth of 30 ft.
- Existing navigation through Union Bay is limited to the navigation corridor. The nautical chart of Lake Washington indicates that water depth outside this corridor is approximately 5 to 7 ft.

If a high level fixed span bridge is used, vertical clearance is assumed to be at least 127 ft, based on the review of navigation clearance for the Aurora Bridge. Additional investigation of navigational uses in the north end of Lake Washington would be needed to determine minimum vertical clearances at Union Bay or Montlake Cut. This additional analysis was not conducted as part of this study, which focused primarily on the SR 520 Bridge corridor and navigation to south Lake Washington. If a high level bridge in this area emerges as a reasonable option, further investigation of navigation needs in the north lake area would be required.





SR520 CORRIDOR

Vertical	70 ft
Horizontal	200 ft
Depth	30 ft



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Figure 4
Navigational Envelope
Recommended

5. PERMIT PROCESS

The US Coast Guard must issue a permit prior to bridge construction. The US Coast Guard has jurisdiction over navigational clearance and location of new bridges across navigable waters of the United States and must approve the design and issue a permit prior to bridge construction. This process begins with submittal of bridge designs, including the minimum navigational corridors, location of bridge structures at the shores, and structure type. Once the bridge design is submitted, the Coast Guard issues a Public Notice and the public has a 30-day comment period.

The US Coast Guard has requested to be a cooperating agency for the preparation of the Trans-Lake Washington Project EIS, and will use the EIS to support its environmental review of the project as part of the permitting process. If no appeals or comments are made, the Coast Guard will finish processing the permit application. A permit can only be issued after the Washington State Department of Ecology has issued a Water Quality Certification.

